



Bayesian Hierarchical Model for Evaluating Efficiency Gains in Ugandan Secondary Schools Systems,

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Abstract

This study examines the efficiency gains in Ugandan secondary schools systems by applying a Bayesian hierarchical model to analyse data from multiple years. A Bayesian hierarchical model was employed to account for variability between schools and regions while estimating efficiency gains. The model incorporates prior knowledge about school performance and uncertainty quantification through credible intervals. The analysis revealed significant heterogeneity in school efficiencies, with some institutions showing substantial improvement over the study period, indicating potential for targeted interventions. The Bayesian hierarchical approach provided nuanced insights into school efficiency gains, highlighting regions that require specific support to enhance educational outcomes. Based on the findings, recommendations include focused training programmes and resource allocation strategies tailored to underperforming schools identified through this analysis. Model estimation used $\hat{\theta} = \operatorname{argmin}\{\theta\} \sum_i \ell(y_i, f(\theta; \xi)) + \lambda \sqrt{\theta} \sqrt{\theta}^2$, with performance evaluated using out-of-sample error.

Keywords: *Bayesian statistics, hierarchical modelling, econometrics, education evaluation, African geography, stochastic processes, inferential methods*

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